1994

Educational Service Center #17's FY92 Scientific Literacy Program

Marilyn Holt

THESIS REPRODUCTION CERTIFICATE

TO: Graduate Degree Candidates who have written formal theses.

SUBJECT: Permission to reproduce theses.

The University Library is receiving a number of requests from other institutions asking permission to reproduce dissertations for inclusion in their library holdings. Although no copyright laws are involved, we feel that professional courtesy demands that permission be obtained from the author before we allow theses to be copied.

Please sign one of the following statements:

Booth Library of Eastern Illinois University has my permission to lend my thesis to a reputable college or university for the purpose of copying it for inclusion in that institution's library or research holdings.

5-11-94

Date

I respectfully request Booth Library of Eastern Illinois University not allow my thesis be reproduced because _____

_____

_____

_____ _____

Date Author

m

Educational Service Center #17's FY92

Scientific Literacy Program

(TITLE)

BY

Marilyn Holt

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

Specialist in Education

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

1994

YEAR

I HEREBY RECOMMEND THIS THESIS BE ACCEPTED AS FULFILLING
THIS PART OF THE GRADUATE DEGREE CITED ABOVE

DATE

DATE

Abstract

The purpose of this study was to evaluate Illinois Educational Service Center #17's Scientific Literacy Program for FY92. Objectives utilized to address this problem were:

1. To determine the effectiveness of the staff development delivered in FY92 which emphasized hands-on approaches to teaching physics concepts to students in grades K-8.

2. To determine the effectiveness of the staff development delivered in FY92 which emphasized hands-on approaches to teaching mathematic concepts to students in grades K-6.

3. To determine the effectiveness of the staff development delivered in FY92 which emphasized hands-on approaches to teaching science process concepts to students in grades K-8.

Teachers participating in the training addressed by these objectives were surveyed to solicit their perceptions of its effectiveness. Further, each of the University's trainers that delivered the staff development were interviewed on his/her perspectives on the training's effectiveness and additional training which may be worthwhile for the future. The study was conducted in the 12 counties composed of ESC #17 which is located in Southeastern Illinois.

The results indicated that the participating teachers felt that the training was effective for each of the components presented in the three objectives. The University trainers also felt that staff development was effective.

Recommendations flowing from this study were:

1. Continue to provide staff development for teachers to increase their knowledge and confidence in science, mathematics, and technology.

2. Provide staff development training focusing on the national trends of science, mathematics, and technology.

3. Provide staff development training on the implementation of science, mathematics, and technology activities into the curriculum.

4. Provide staff development training on techniques for performance assessment in science, mathematics, and technology.

5. Provide staff development training incorporating an interdisciplinary approach focusing on problem solving and higher order thinking skills with science, mathematics, language arts, and technology.

Table of Contents

Chapter I

Introduction and Background for the Problem

Introduction

Commencing in 1989 the Illinois State Board of Education, through legislative appropriations, funded scientific literacy programs in public schools, educational service centers, and non-profit organizations such as professional organizations and museums. The thrust of programs funded was to enhance experimental or demonstration programming in the public schools and improve teachers' knowledge and skills for teaching science, mathematics, and technology through staff development programs at the service centers and non-profit organizations.

In FY92, the Illinois State Board of Education allocated to each of the state's 18 educational service centers approximately $150,000 on a non-competitive basis for scientific literacy staff development training. Prior to this, service center grants were competitive. FY92 was selected as the year to evaluate because it represents for Educational Service Center #17 a situation where programming was most likely to be effective based on resources. While the program was funded in FY93, this year was not included in the evaluation because conditions in the service center made it difficult to fully implement the program. The service center is now in the FY94 program and has a great need to have evaluative data from FY92 to determine what changes need to be made.

During the last several years much attention has been given to the need of improving scientific literacy skills of students in America. This includes science, mathematics, and technology. A role of educational service centers in Illinois is to provide staff development to teachers of science, mathematics, and technology. The logic is that enhancing the teaching skills of these individuals will enhance the skills of students in science, mathematics, and technology.

Statement of the Problem

The major problem of this project is to evaluate Educational Service Center #17's Scientific Literacy Program for FY92. The rationale for this study is predicated on the need of Educational Service Center #17 to make judgments about modifications which may be needed in its present scientific literacy efforts. The general results which are hoped to be brought about are specific decisions which can be made to improve the scientific literacy program at Educational Service Center #17.

Project Objectives

The objectives of this project are:

1. To determine the effectiveness of the staff development delivered in FY92 which emphasized hands-on approaches to teaching physics concepts to students in grades K-8 as measured by the perceptions of the teachers receiving the staff development and the trainer delivering the staff development.

2. To determine the effectiveness of the staff development delivered in FY92 which emphasized hands-on approaches to teaching mathematics

concepts to students in grades K-6 as measured by the perceptions of the teachers receiving the staff development and the trainer delivering the staff development.

3. To determine the effectiveness of the staff development delivered in FY92 which emphasized hands-on approaches to teaching science process concepts to students in grades K-8 as measured by the perceptions of the teachers receiving the staff development and the trainer delivering the staff development.

Definition of Terms

The following definitions are germane to understanding their context for this study:

1. Staff Development. The training provided to teachers in the 10 target schools through ESC #17.

2. Scientific Literacy. The knowledge and skills that students need to possess in science, mathematics, and technology to make contributions to society, determine possible career opportunities, and function as responsible citizens at the present and in the future.

3. Educational Service Center #17. One of 18 educational service centers in Illinois created in 1985 to provide staff development for teachers and administrators in the areas of gifted education, technology, reading, mathematics, and science education, Administrators' Academy, Vocational Instructor Practicum, special education, and other programs as determined by the Illinois State Board of Education.

The aforementioned definitions are presented solely as operational definitions as opposed to theoretical definitions.

Assumptions

It is assumed that the perceptions of the teachers from target schools and the trainers from Eastern Illinois University will provide meaningful information pertaining to the effectiveness of the staff development training in FY92.

Delimitations

Outside the scope of this study was the inclusion of the utilization of the FY93 Scientific Literacy program. This was due to problems beyond control of ESC #17 to fully implement the program in the FY93 school year.

While student achievement data may be perceived as logical measures to be utilized, many variables in addition to the training delivered through ESC #17 affect it. Thus, student achievement data were not included.

Chapter II

Rationale, Literature and Related Research

Rationale

This study is based on the premise that evaluating the three components of ESC #17's FY92 Scientific Literacy program will be beneficial to future program improvements. Further it is believed that training teachers in science, mathematics, and technology will enhance students' performances in these areas.

Review of Literature and Research

Yager (1988) advocates that it is ineffective to teach science as a review of what scientists know. According to Yager, this approach results in students perceiving that there is minimal use for what they learn and stifles their desire to study science. He believes that many students develop a negative attitude toward science when this approach is used. Based on Yager's previously mentioned analysis, staff development is imperative if the teaching of science is to move forward and meet the present and future needs of students.

Science Teachers Speak Out (National Science Teachers Association, 1990) stresses that "our nation must have a citizenry that is prepared to understand and deal rationally with the issues and opportunities of a scientific and technological world" (p. 1). This report indicates the need for administrative support regarding the teaching of science.

Pallrand's (1989) review of science education indicates, "In the last several years, more than 100 national reports and studies critical of

education have appeared, and science education has been singled out for its share of criticism" (p. 421). He sites the glaring discrepancies between the outstanding advancements and accomplishments of science and technology and the less than exciting manner in which these advancements are represented in the school curriculum. Further, Pallrand stresses that continued advancement in science and technology is dependent upon well trained individuals, and schools may not be able to produce those individuals. He suggests that public schools should establish linkages with universities and industrial research laboratories in order to enrich science education and stimulate students to pursue careers in science.

Fort (1990) notes that "society has never needed individuals with gifts in science and technology more than it does as the 20th century comes to an end" (p. 665). Fort explains that science information is doubling every five years, and she questions schools' ability to produce students who have the capability of mastering and applying this growth of scientific knowledge. The author also emphasizes the following:

1. The twin goals of achieving scientific literacy for all and encouraging excellence for the gifted are inextricably linked.

2. Students discover gifts in science by trying their hands at it - provided they have an opportunity to do so.

3. It is with regard to the activating factor that teachers and schools have the most to offer students of all ability levels.

4. Without an improvement in science education for all students, those with gifts in science will suffer--and so will society. (p. 667-670)

While Fort focuses on gifted students, she also stresses the importance of improving science for all students, regardless of skill level. The information generated by Fort regarding science information being doubled every five years demonstrates a need for staff development. More specifically, "science process" is a teaching approach to science which allows teachers to be up-to-date without having to know the information which is being doubled every five years. However, in the researchers' experiences, most K-8 teachers are unfamiliar with the skills needed to utilize the science process.

Estes (1990) indicates that K-8 teachers need staff development not only because of the information explosion in science but because of their general lack of preparation in science. She describes a Texas project headed by James Barufoldi that was concerned with the low priority of science at the elementary level and the lack of science inquiry. This project introduced teachers to physical science because of their unfamiliarity with and fear of physical science.

Raizen and Kaser (1989) studied the problems of assessment in science which they believe lead directly to problems with the instruction of science. They found that "the amount of time spent on science in elementary schools is limited, teachers are not trained to teach science, and the usual forms of assessment do not address some of the most important goals of science education" (p. 720).

Fort (1993) indicates that "Americans of all ages and in all walks of life tend to be scientifically and technologically illiterate. And what we do not know, we fear--and approach with anxiety, if we approach it at all" (p. 675). Fort notes that teachers in particular need to experience science and technology as they exist in reality so that they can understand and have confidence in their knowledge. Teachers should approach science and technology with an attitude that they can understand and then open the world of science to themselves and their students.

The American Association for the Advancement of Science's (1989) report, entitled Science For All Americans: A Project 2061 Report On Literacy Goals In Science, Mathematics, And Technology, indicates that an interdisciplinary approach needs to be taken in teaching science literacy skills. The report also stresses that there should be more of an emphasis on critical thinking skills and less emphasis placed on memorizing facts. Use of the interdisciplinary approach and an emphasis on the critical thinking skills are concepts which need to be addressed by staff development to ensure that elementary teachers can utilize their effectiveness in teaching science.

Pejouhy (1990) discusses math teachers resistance to the National Council of Teachers of Mathematics reforms. She suggests that many teachers are intimated by mathematics, lack confidence in their ability to teach mathematics, and falsely hope their lack of understanding will not be noticeable in early elementary grades. She recommends staff development

programs that boost the confidence of elementary teachers by increasing their understanding of mathematics.

Knapp, Stearns, St. John, and Zuker (1988) identify the following areas for improving scientific literacy education:

1. The content in science and mathematics is often inappropriate and does not always match students' interests with their cognitive development. Further, it often neglects to reflect contemporary ideas in mathematics and science and does not furnish students with the kinds of knowledge and intellectual needs of modern society.

2. Many science and math teachers are underqualified and, thus, instruction suffers.

3. Organizational elements within the educational community often constrain improvements and reinforce the status quo. Administrative support has a great deal to do with the quality of mathematics and science instruction.

The aforementioned point out the need for staff development because many elementary teachers, while legally qualified, may be unqualified in a practical sense to effectively teach science.

The previous review of literature and research demonstrates the need for staff development which focuses on improving the skills of K-8 teachers who teach science. The focus of this project is on evaluating how effective the staff development provided by ESC #17 in the area of scientific literacy has been for K-8 teachers who participate in the FY92 target school program.

Summary

The review of literature and research indicates that:

1. Our country needs citizens who are scientifically and technologically literate.

2. There is a glaring discrepancy between the achievements and accomplishments of science and technology and the less than exciting manner in which these advancements are represented in the school curriculum.

3. Teachers and especially elementary teachers lack a knowledge base as well as confidence in science, mathematics, and technology.

4. Students need to be actively engaged in learning science, mathematics, and technology with an emphasis on critical thinking skills and less emphasis on memorization of facts.

5. Staff development is necessary to improve the skills of K-8 teachers who teach science, mathematics, and technology.

Chapter III

Design of the Study

Overview

The field experience was carried out by the researcher who is the Director of ESC #17. The people involved were the teachers and principals from the 10 target schools in the FY92 scientific literacy program and the three University trainers who deliver the staff development (Dr. Henry Taitt, Dr. Marylin Lisowski, and Dr. Allen Davis; all from Eastern Illinois University).

In that this field experience is an evaluation, the concepts of dependent and independent variables are not as applicable as in an experimental study. However, the dependent variable is the perception of the staff development effectiveness as perceived by the respondents. The independent variable is simply the type of respondent - teachers and staff development trainers. Because this is an evaluation type of field experience, the independent variable was not manipulated. These variables were selected for study because they represent the essence of evaluating the effectiveness of ESC #17's scientific literacy staff development.

Research Questions

The three research questions were:

1. How effective was the staff development which emphasized hands-on approaches to teaching physics concepts to students in grades K-8?

2. How effective was the staff development which focused on the use of math manipulatives and other hands-on approaches to teaching mathematics knowledge and skills in grades K-6?

3. How effective was the staff development which focused on teachers utilizing science process to teach any science skills in grades K-8?

Instrumentation

Appendix A presents the questionnaire used to collect the perceptions of the teachers who partook of the scientific literacy training. The same questionnaire was used for each of the research questions. Appendix B presents the probes used to interview Dr. Taitt (Staff Development Trainer for content covered in Research Question #1), Dr. Lisowski (Staff Development Trainer for content covered in Research Question #2), and Dr. Davis (Staff Development Trainer for content covered in Research Question #3).

Data Collection

The questionnaire was administered to participating teachers at the end of each staff development component during the 1991-92 school year. The interview data were collected in March of 1994. (The interview data were collected at this late date because this component was added by the field experience supervisor.)

Data Analysis

The questionnaire results were analyzed using descriptive statistics in the form of frequencies and percentages. Qualitative analysis was used to analyze the interview data.

Chapter IV

Results

Overview

The results are presented for each of the research questions through a table and commentary.

Results for Research Question #1

Research Question #1: How effective was the staff development which emphasized hands-on approaches to teaching physics concepts to students in grades K-8?

Results for the Questionnaire. Item 11 in Table 1 indicates that the average participant response was 5.28. As Table 1 indicates, scores could range from a possible low of 1 to a high of 7. In general, participants' overall ratings based on a summation of the 10 items was very positive toward the training.

For the 10 items, the lowest mean was 4.08 for Item 5, with the highest mean being 6.17 for Item 3. Even considering the lowest rated item, the results for all items were favorable toward the training.

Reflections of Trainer (Dr. Henry Taitt). A summation of the interview with Dr. Taitt indicated the following:

1. Teachers were anxious about "hands-on" science and wanted ideas to share with their students.

2. This training provided instruction to the teacher, an opportunity for the teacher to implement the activity in the classroom, and to return for continued support and staff development.

Table 1

Participants' Evaluations Of The Hands-On Methods to Teaching Physics Concepts

	Extremely Inadequate 1	2	3	4	5	6	Extremely Adequate 7	N	Mean
1. The depth of information covered was:	0 (0%)	1 (2%)	2 (4%)	17 (35%)	11 (23%)	11 (23%)	5 (11%)	47	4.93
	Highly Unimportant						**Highly Important**		
	1	2	3	4	5	6	7	N	Mean
2. The importance of content overall to my job was:	0 (0%)	1 (2%)	7 (15%)	9 (19%)	15 (32%)	10 (21%)	5 (11%)	47	4.87
	Extremely Low						**Extremely High**		
	1	2	3	4	5	6	7	N	Mean
3. My confidence in the validity of the information was:	0 (0%)	0 (0%)	0 (0%)	6 (13%)	1 (2%)	19 (40%)	21 (45%)	47	6.17
	Extremely Poor						**Extremely Clear**		
	1	2	3	4	5	6	7	N	Mean
4. Overall, the sequencing of the information presented is:	1 (2%)	1 (2%)	2 (4%)	9 (19%)	16 (34%)	14 (30%)	4 (9%)	47	5.04

Table 1 (Continued)

	Extremely Confusing 1	2	3	4	5	6	Extremely Clear 7	N	Mean
5. The transition from one session to another was:	2 (4%)	2 (4%)	6 (13%)	16 (34%)	8 (17%)	9 (19%)	4 (9%)	47	4.08

	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
6. Overall the methods (lectures, exercises, discussion, etc.) were:	0 (0%)	0 (0%)	0 (0%)	8 (20%)	10 (25%)	12 (30%)	10 (25%)	40	5.60

	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
7. The demonstrations were:	0 (0%)	0 (0%)	3 (6%)	11 (23%)	10 (21%)	10 (21%)	13 (28%)	47	5.40

	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
8. The materials and handouts were:	0 (0%)	2 (4%)	4 (9%)	6 (13%)	5 (11%)	10 (21%)	20 (43%)	47	5.63

Table 1 (Continued)

	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
9. The presenter's oral presentations were:	0 (0%)	3 (6%)	2 (4%)	8 (17%)	8 (17%)	15 (32%)	11 (23%)	47	5.34
	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
10. The presenter's management of workshop participation was:	0 (0%)	1 (2%)	3 (6%)	10 (21%)	5 (11%)	17 (36%)	11 (23%)	47	5.42
	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
11. Overall results for items 1-10:	3 (0%)	11 (2%)	29 (6%)	100 (21%)	89 (19%)	127 (27%)	104 (22%)	463	5.28

3. Teachers enjoyed the training, used the activities in their classrooms, and continue to seek new ideas for their students.

4. Suggested future trainings include an interdisciplinary approach focusing on problem solving and higher order thinking skills with science, mathematics, language arts, and technology.

Results for Research Question #2

Research Question #2: How effective was the staff development which focused on the use of math manipulatives and other hands-on approaches to teaching mathematics knowledge and skills to students in grades K-6?

Results for the Questionnaire. Item 11 in Table 2 indicates that the average participant response was 6.24. As Table 2 indicates, scores could range from a possible low of 1 to a high of 7. In general, participants' overall ratings based on a summation of the ten items was very positive toward the training.

For the 10 items, the lowest mean was 6.09 for Item 6, with the highest mean being 6.54 for Item 3. Even considering the lowest rated item, the results for all items were favorable toward the training.

Reflections Of Trainer (Dr. Allen Davis). A summation of the interview with Dr. Davis indicated the following:

1. Teachers wanted to provide better instruction to students in mathematics and specifically in the area of problem solving.

Table 2

Participants' Evaluations Of The Mathematics Manipulatives For The Teaching Of Mathematics

	Extremely Inadequate 1	2	3	4	5	Extremely Adequate 6	7	N	Mean
1. The depth of information covered was:	1 (1%)	0 (0%)	1 (1%)	5 (5%)	14 (13%)	37 (36%)	46 (44%)	104	6.13

	Highly Unimportant 1	2	3	4	5	6	Highly Important 7	N	Mean
2. The importance of content overall to my job was:	0 (0%)	0 (0%)	3 (3%)	4 (4%)	20 (20%)	25 (25%)	47 (47%)	99	6.10

	Extremely Low 1	2	3	4	5	6	Extremely High 7	N	Mean
3. My confidence in the validity of the information was:	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5 (5%)	37 (36%)	61 (59%)	103	6.54

	Extremely Poor 1	2	3	4	5	6	Extremely Clear 7	N	Mean
4. Overall, the sequencing of the information presented is:	0 (0%)	0 (0%)	0 (0%)	3 (3%)	11 (12%)	36 (38%)	45 (47%)	95	6.29

Table 2 (Continued)

	Extremely Confusing 1	2	3	4	5	6	Extremely Clear 7	N	Mean
5. The transition from one session to another was:	0 (0%)	0 (0%)	1 (1%)	1 (1%)	14 (14%)	39 (39%)	45 (45%)	100	6.26
	Very Ineffective 1	2	3	4	5	6	**Very Effective 7**	N	Mean
6. Overall the methods (lectures, exercises, discussion, etc.) were:	0 (0%)	0 (0%)	3 (3%)	5 (5%)	16 (14%)	42 (38%)	45 (41%)	111	6.09
	Very Ineffective 1	2	3	4	5	6	**Very Effective 7**	N	Mean
7. The demonstrations were:	0 (0%)	0 (0%)	2 (2%)	3 (3%)	15 (14%)	37 (34%)	52 (48%)	109	6.22
	Very Ineffective 1	2	3	4	5	6	**Very Effective 7**	N	Mean
8. The materials and handouts were:	0 (0%)	0 (0%)	3 (3%)	4 (4%)	11 (11%)	22 (22%)	60 (60%)	100	6.32

Table 2 (Continued)

	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
9. The presenter's oral presentations were:	0 (0%)	0 (0%)	2 (2%)	1 (1%)	17 (17%)	34 (35%)	44 (45%)	98	6.19

	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
10. The presenter's management of workshop participation was:	0 (0%)	0 (0%)	2 (2%)	4 (4%)	7 (8%)	33 (36%)	45 (49%)	91	6.26

	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
11. Overall results for items 1-10:	1 (0%)	0 (0%)	17 (1%)	30 (2%)	130 (12%)	342 (33%)	490 (48%)	1010	6.24

2. Teachers were provided the tools, techniques, and training necessary to improve instruction to students.

3. Teachers returned to their classrooms with increased knowledge, materials, and excitement in mathematics.

4. Suggested future training include parent involvement or "family math," use of the calculator, cooperative learning as a method for enhancing learning, performance assessment and a focus on the national trends of mathematics.

Results for Research Question #3

Research Question #3: How effective was the staff development which focused on teachers utilizing the process of science process to teaching any science skills to students in grades K-8?

Results for the Questionnaire. Item 11 in Table 3 indicates that the average participant response was 6.49. As Table 3 indicates, scores could range from a possible low of 1 to a high of 7. In general, participants' overall ratings based on a summation of the ten items was very positive toward the training.

For the 10 items, the lowest mean was 6.13 for Item 2, with the highest mean being 6.77 for Item 3. Even considering the lowest rated item, the results for all items were favorable toward the training.

Reflections Of Trainer (Dr. Marylin Lisowski). A summation of the interview with Dr. Lisowski indicated the following:

Table 3

Participants' Evaluations Of The Use Of Science Process for Teaching Science Component

	Extremely Inadequate 1	2	3	4	5	Extremely Adequate 6	7	N	Mean
1. The depth of information covered was:	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (12%)	17 (29%)	34 (59%)	58	6.46

	Highly Unimportant 1	2	3	4	5	6	Highly Important 7	N	Mean
2. The importance of content overall to my job was:	0 (0%)	0 (0%)	2 (3%)	6 (10%)	7 (12%)	10 (17%)	33 (57%)	58	6.13

	Extremely Low 1	2	3	4	5	6	Extremely High 7	N	Mean
3. My confidence in the validity of the information was:	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (5%)	7 (12%)	48 (83%)	58	6.77

	Extremely Poor 1	2	3	4	5	6	Extremely Clear 7	N	Mean
4. Overall, the sequencing of the information presented is:	0 (0%)	0 (0%)	0 (0%)	1 (2%)	7 (12%)	19 (33%)	31 (53%)	58	6.37

Table 3 (Continued)

	Extremely Confusing 1	2	3	4	5	6	Extremely Clear 7	N	Mean
5. The transition from one session to another was:	0 (0%)	0 (0%)	0 (0%)	0 (0%)	12 (21%)	21 (36%)	25 (43%)	58	6.22

	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
6. Overall the methods (lectures, exercises, discussion, etc.) were:	0 (0%)	1 (2%)	0 (0%)	1 (2%)	5 (9%)	9 (16%)	42 (72%)	58	6.53

	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
7. The demonstrations were:	0 (0%)	1 (2%)	0 (0%)	1 (2%)	4 (7%)	10 (17%)	42 (73%)	58	6.55

	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
8. The materials and handouts were:	0 (0%)	1 (2%)	0 (0%)	0 (0%)	2 (3%)	7 (12%)	48 (83%)	58	6.72

Table 3 (Continued)

	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
9. The presenter's oral presentations were:	0 (0%)	1 (2%)	1 (2%)	1 (2%)	1 (2%)	12 (21%)	42 (72%)	58	6.55

	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
10. The presenter's management of workshop participation was:	1 (2%)	0 (0%)	0 (0%)	1 (2%)	3 (5%)	7 (12%)	45 (78%)	57	6.61

	Very Ineffective 1	2	3	4	5	6	Very Effective 7	N	Mean
11. Overall results for items 1-10:	1 (0%)	4 (0%)	3 (0%)	11 (1%)	51 (8%)	119 (20%)	390 (64%)	579	6.49

1. Teachers actively participated in the entire training.

2. Feedback during the training and the specific activities, indicated teachers planned to include the strategies and activities in their classrooms.

3. Suggested future training includes techniques for assessment, plans for implementation of science activities into the curriculum, emphasis on the Illinois Goals for Learning dealing with environment and the principles of scientific research and leadership development of teacher leaders.

Chapter V

Summary and Recommendations

Review of the Study

The Illinois State Board of Education began in 1989 to fund through legislative appropriations scientific literacy programs in public schools, educational service centers, and non-profit organizations. The purpose of the programs was to enhance demonstration programming in the public schools and improve teachers' knowledge and skills for teaching science, mathematics, and technology through staff development.

In 1992 the Illinois State Board of Education allocated approximately $150,000 to each educational service center for scientific literacy staff development training. The purpose of this study was to evaluate Educational Service Center #17's Scientific Literacy Program in FY92. The rationale for this problem was predicated on the need of Educational Service Center #17 to make judgments about modifications which may be needed in present scientific literacy efforts.

This field experience was conducted by the researcher who is the Director of ESC #17. The study involved the teachers and principals from the 10 target schools in the FY92 Scientific Literacy program and other staff from ESC #17. The following research questions were asked to the teachers and principals:

1. How effective was the staff development which emphasized hands-on approaches to teaching physics concepts to students in grades K-8?

2. How effective was the staff development which focused on the use of math manipulatives and other hands-on approaches to teaching mathematics knowledge and skills to students in grades K-6?

3. How effective was the staff development which focused on teachers utilizing the process of science process to teaching any science skills to students in grades K-8?

In addition to the three research questions, trainers and other ESC #17 staff were interviewed and asked to reflect on the effectiveness of the training and to give suggestions for future training.

Summary of Results

Research Question #1 was: How effective was the staff development which emphasized hands-on approaches to teaching physics concepts to students in grades K-8?

Participants responded favorably toward the training. On a score with 1 being the lowest to 7 as the highest, the average participant response was 5.28.

Research Question #2 was: How effective was the staff development which focused on the use of math manipulatives and other hands-on approaches to teaching mathematics knowledge and skills to students in grades K-6?

Participants responded favorably toward the training. On a score with 1 being the lowest to 7 as the highest, the average participant response was 6.54.

Research Question #3 was: How effective was the staff development which focused on teachers utilizing the process of science process to teaching any science skills to students in grades K-8?

Participants responded favorably toward the training. On a score with 1 being the lowest to 7 as the highest, the average participant response was 6.77.

Recommendations

Based on this study the following recommendations are offered for further Scientific Literacy training in ESC #17:

1. Continue to provide staff development for teachers to increase their knowledge and confidence in science, mathematics, and technology.

2. Provide staff development training focusing on the national trends in science, mathematics, and technology.

3. Provide staff development training on the implementation of science, mathematics, and technology activities into the curriculum.

4. Provide staff development training on techniques for performance assessment in science, mathematics, and technology.

5. Provide staff development training incorporating an interdisciplinary approach focusing on problem solving and higher order thinking skills with science, mathematic, language arts, and technology.

References

American Association for the Advancement of Science. (1989). Science for all Americans: A project 2061 report on literacy goals in science, mathematics, and technology. Washington, D.C.

Estes, Y. B. (1990). Breakout: Catch a wave in science. Phi Delta Kappan, 71(9), 686-691.

Fort, D. C. (1990). From gifts to talents in science. Phi Delta Kappan, 71(9), 665-671.

Fort, D. C. (1993). Science shy, science savvy, science smart. Phi Delta Kappan, 74(9), 674-683.

Knapp, M. S., Sterns, M.S., & St. John, M., & Zuker, A. A. (1988). Perspective for improving K-12 science from the federal level. Phi Delta Kappan, 69(7), 677-683.

National Science Teachers Association. (1990). Science teachers speak out: The NSTA lead paper on science and technology for the 21st century. Washington, D.C.

Pallrand, G. J. (1989). Science, technology, and public knowledge. Phi Delta Kappan, 70(6), 460-464.

Pejouhy, N. H. (1990). Teaching math for the 21st century. Phi Delta Kappan, 72(1), 76-78.

Raizen, S. A., & Kaser, J. S. (1990). Assessing science learning in elementary school: Why, what and how? Phi Delta Kappan, 70(9), 718-722.

Yager, R. E. (1988). Achieving useful science: Reforming the reforms of the 60's. Educational Leadership, 46(1).

Appendix A

PARTICIPANTS' EVALUATION OF STAFF DEVELOPMENT SESSIONS

Scientific Literacy Target School Program
Educational Service Center #17
FY-94

INSTRUCTIONS: Please provide the following information to help us evaluate the effectiveness of this training.

A. Participant Information

1. Your Position_____

B. Content And Delivery

For each item below, mark the number that most nearly represents your evaluation of this training.

1. The depth of information covered was:	Extremely Inadequate	1	2	3	4	5	6	7 Extremely Adequate
2. The importance of content overall to my job is:	Highly Unimportant	1	2	3	4	5	6	7 Highly Important
3. My confidence in the validity of the information presented is:	Extremely Low	1	2	3	4	5	6	7 Extremely High
4. Overall, the sequencing of the information presented was:	Extremely Poor	1	2	3	4	5	6	7 Extremely Good

	Extremely Confusing						Extremely Clear
5. The transition from one concept to another was:	1	2	3	4	5	6	7

For each item below, mark the number that most nearly describes your evaluation of the effectiveness of the instructional methods.

	Very Ineffective						Very Effective
6. Overall, the methods (Lectures, exercises, discussion, etc.) were:	1	2	3	4	5	6	7
7. The demonstrations were:	1	2	3	4	5	6	7
8. The material and handouts were:	1	2	3	4	5	6	7
9. The presenter's oral presentations were:	1	2	3	4	5	6	7
10. The presenter's management of workshop participation was:	1	2	3	4	5	6	7

Please complete the following:

11. It would have been better if the presenter:

12. The best part of the presenter's performance was:

13. To improve the training, you could:

14. Please list any general comments you wish to express about the training.

15. Please list any additional training which you believe would help you be more effective in teaching science.

Appendix B

PROBES USED TO INTERVIEW THE UNIVERSITY TRAINERS FOR STAFF DEVELOPMENT

Evaluation Of 1992 Scientific Literacy Program

1. Based on your interactions with trainees at the time of the workshop(s), what are your impressions of its effectiveness in meeting their classroom needs?

2. Having had time to reflect upon the training, what suggestions do you have for future training on similar topics?